



Technical progress mechanism in HLS storage ring

Xiangtao Pei, Wei Wei, Yuanzhi Hong, Le Fan, Bo Zhang, Yong Wang

National Synchrotron Radiation Laboratory, University of Science and Technology of China, Hefei 230027, China

Introduction

Efforts have been constantly made to improve the machine performance since the new reconstruction project of Hefei Light Source (HLS) started. The latest design for the HLS lattice aimed at the beam energy of 800 MeV, beam current at 300 to 500 mA, emittance smaller than 36nmrad, has been proposed. Important factors that affect the beam stability have been identified as power supply jitters, electronic drifts, temperature fluctuations in the ring, and ground or flow induced vibrations. However mechanical stability of the magnet girder assemblies (MGA) in a storage ring is essential for electron beam stability and performance, since the mechanical vibrations can be amplified on the electron beam closed orbit by more than ten times by the quadrupole magnets. Therefore, to ensure high level orbit stability for HLS, mechanical stability of the storage ring's MGA should be improved to reduce the amplification between the ground and quadrupole vibration. Vibration tests and calculate simulation are ongoing at the HLS to monitor the performance of the MGA prototype.

Design concepts

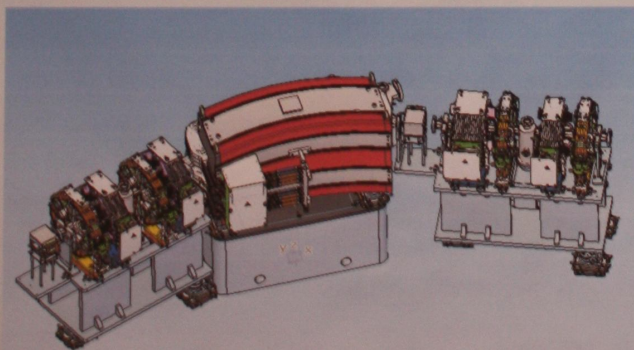


Fig 1 main components of MGA

The storage ring, with a circumference of 66.13 m, has 4-fold super period of DBA structure with 16 unit cells in total. Currently many of the world's third-generation synchrotron radiation light source have similar magnet supporting agencies. Fig 1 presents a schematic view of the main components of MGA will be installed at the HLS. The MGA can be divided into two layers of adjustment mechanism. the first layer using a three-point support achieve three-dimensional wide range of adjustment $\pm 10\text{mm}$, and the adjustment accuracy of the second layer guarantee magnet mounting accuracy. One of the most crucial is the processing quality of magnet mounting plane.

Vibration tests



Fig 2 vibration measurement device

of successive scans were carried out repeatedly. The assembly of vibration measurement device is shown in Fig 2, including DH5922 dynamic signal test system, DH610 magnetic-electric speed sensor (frequency range 0.1-100Hz, Sensitivity 15V/ms-1), Sampling frequency of 512Hz.

Results and discussion



(a) ground



(b) magnet upper apex

Fig 3 24 hours vertical vibration displacement of real-time data

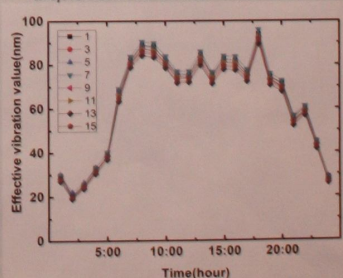


Fig 4 vibration RMS value of all vertical test points average hourly

All mechanical processing were completed by Hefei JuNeng company. In the following the test vibration measurements of the existing MGA were performed to demonstrate the mechanical stability performance. Comparison

As shown at the Fig 3 and 4, 24 hours vertical vibration displacement of real-time data were achieved (test points 1 and 3 -on the ground, 5 and 7-on the magnet mounting plane, 9,11,13 and 15- respectively on the magnet upper apex).

The vertical vibration displacement values of the respective measuring points were in a range of 19.1 nm - 95.9 nm. In a day from 6:00 to 22:00, the vibration value is large, conversely the value is small from 23:00 to 5:00. The MGA vertical magnification related to the ground is about 1.

Conclusion

The new MGAs for HLS have been successfully completed and the vibration measurement system was tested with the existing MGA. The results show a good reproducibility and vibration response to meet the design requirements.